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THE AMERICAN GAS LIGHT JOURNAL

REDWANKENNY.N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LVIII.—No. 21. Whole No. 937. | NEW YORK, MONDAY, MAY 22, 1893. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. B. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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SPECIAL EDITORIAL CORRESPONDENCE BY TELEGRAPH.

CHICAGO, May 18, 1893.

Dear JOURNAL: No, it is not necessary to write that Chicago is in Illinois, from which the plain, the only, inference is that Chicago is in the United States. And so it is; very much just now, and likely to be more so in the next four or five months—and those who come here in the next four or five months are not likely to forget what they have seen, heard and absorbed. Good things, however, come high; and some of them at least are worth the money. Excuse the prelude; it is pitched, nevertheless, in the key of the day at this point. A rather dull and prosaic trip found us in the "Windy City" some time in advance of even the earlier birds; but as Brother Whipple, of the Victoria, had kept his word in respect of "holding" accommodations, we were not obliged to either stalk through the lobbies or to "take chances" with strangers; consequently time was not heavy until we were greeted by others of the advance guard of the Western. The Committee of Arrangements was represented by a half dozen spry Chicagoese, all very much "up to date," who saw to it that those who reported a trifle in advance were well taken care of; and here I would say that much of the ease and harmony which prevailed is to be put down to the credit of the committee. However, to come to the point. I need not say anything about the meeting room, for that was all right. President Chollar, looking a trifle more solemn than usual, and Secretary Littleton (the same old "Gus."), evidently did not look for so good an attendance on the opening day, since the first twitched his glasses (eye-pieces, of course) with unnecessary vigor, while Littleton, do what he could, was unable to repress a sunbeamy smile. The visiting delegation from our section was not quite up to standard in point of numbers, although the Slaters, father and son, Commissioner Barker, Fred. Floyd, W. W. Goodwin, S. F. Hayward, Wm. R. Beal, Edwin Ludlam, C. M. Higgins, T. G. Lansden and others showed that the effete East was still "in it." Of the absentees it might be best to say nothing, although it was with great sorrow and earnest sympathy that we all heard why Col. Croul, of Detroit, and his lieutenants, Vice-President Baxter and J. T. Lynn, were prevented from attending the meeting. The Colonel's daughter was stricken by death, and Mr. Lynn suffered a terrible bereavement in the loss of his estimable wife, whose sudden demise occurred on the 13th inst. It was determined to expedite the business sessions of the meeting with every possible despatch, and the result was that the regular order was finished at a timely hour yesterday afternoon. Nor was anything slighted.

President Chollar, in his inaugural, succeeded admirably in his message. As those who have closely (or even with fair approach thereto) read Mr. Chollar's literary productions, that were prepared for the public eye and mind, well know, his methods and matter are simple and concise, but never at the expense of lack of wisdom nor in point of well-portrayed moral. Many well-prepared, original and thoughtful presidential messages have been delivered before the Western Association, and so the praise is all the greater when I say that his outranks them for originality and fertility. The fact of the matter is, Chollar ought to be a newspaper man—and that suggestion absolutely leads to the remembrance that he once was a pencil pusher. Be it so or not, his address was a masterly one, as the manner in which it was received amply

attested. The papers were akin to those which the Western usually has the good fortune to listen. While they were not abstruse; neither were they pointless; and all were free from the blemish of even a suspicion that anybody was attempting to advertise either process or wares. The discussions were not particularly spirited, unless exception be made in the case of the argument on "The Duty of Gas Companies to their Customers;" but in this instance the dialogue represented no particular divergence over the main end to be attained—all agreed that the practices of 20 years ago in the treatment of gas consumers by gas companies would not do for to-day; nor to-morrow, either. Mr. Thompson brought out many a "Wrinkle" in the concise and presentable fashion that he commands so well, and Mr. Ferrier's paper on "Residuals" shows that many a Southern and Western gas man has a scowl and a growl for the tar trust and its allies. Mr. Thwing read a well-thought out, practical paper on "Gas Analysis," that will bear close study, and Mr. Smedberg was in his happiest vein in his communication on "Wood Gas During the War." President Chollar and that imperturbable second of his, Secretary Littleton, kept the business well in hand; and, as was before remarked, while routine was expedited, nothing was slighted. The weather conditions were excellent, and the arrangements ditto. The officers elected for the ensuing year were:

President—E. H. Jenkins, Columbus, Ga.
First Vice-President—I. C. Baxter, Detroit, Mich.
Second Vice-President—Wm. H. Odiorne, Springfield, Ills.
Secretary and Treasurer—A. W. Littleton, Quincy, Ills.
Directors—R. Spencer, J. W. Stratton, R. F. Fitz, Jas. R. Smedberg, William McDonald, Jas. Ferrier, G. T. Thompson, B. A. Ward, B. E. Chollar.

The next place for meeting will be Cleveland, Ohio; the mention of which city recalls the fact that among those who evidently enjoyed the meeting was Mr. M. S. Greenough, who hereafter will regularly respond to the roll call. Twenty one new members were elected, which brings the muster very close to the 300 mark. I hope to send a paragraph or two to-morrow that will reach you before the time of going to press. ***

CHICAGO, May 19, 1893.

Dear JOURNAL: The banquet last night was indeed a feast for mind and body. Mine Host Kinsley has always been a favorite with the gas men, and it goes without saying that when the Delmonico of the West starts out to accomplish something beyond the ordinary, he never fails to please his guests, and thus do complete justice to himself. Members and guests to the number of 230 enjoyed the hospitalities of the "Gas Industries of Chicago," and no other 230 ever had a better time. Many of the prominent officials of the city, and a goodly representation of the executive staff of the World's Fair were present, and possibly the speech of the evening was delivered by Director Bryan. The real incident of the banquet, however, was the presentation to President Chollar of a magnificent watch and chain, which timepiece and cable were happily intended to replace articles of a similar nature from which Chollar was parted by the successful daring of a St. Louis thief some months ago. The presentation speech was made by President-elect Jenkins, and the clever Georgia gas man was in his happiest vein. 'Tis not easy to imagine Chollar blushing, and equally difficult to behold him rattled; but candor forces the verdict that he both blushed and stammered. The whole thing was carried out quietly and well, for a master hand guided the preliminaries.

The musical programme was a most enjoyable feature of the feast, and the committee in charge of the "function" deserve and received the hearty congratulations of all. I will not attempt to be specific in this message; but I must say that everything was as it should be. The Committee of Arrangements very wisely decided not to prepare any set programme for the entertainment of the Association to-day (Friday), for all are bent on doing the Fair. In connection with the latter I fear the visitors will not be over-pleased. There is no disguising the fact that the grounds, buildings and exhibits are in a decidedly uneven condition. The scope and plan of the mammoth affair are undeniably grand, and when something like order has been evolved, the Exhibition will undoubtedly be the grandest World's panorama and international kaleidoscope that ever was arranged; but to the eye of a novice a month at least will be blotted out before the visitor will be enabled to discerningly inspect and admire the wonders that have been gathered from every quarter of the globe for the adornment of the Columbian World's Fair. ***

THE officers chosen at the meeting of the Hagerstown (Md.) Light and Heat Company were: President, Henry Steck; Secretary and Treasurer, C. F. Manning; Superintendent, E. B. Knight. A dividend of 3 per cent. was declared, and the net rate for gas was reduced to $1.75 per 1,000.

The Yeadon Rotary System of Gas Making.

[A paper read by Mr. D. Terrace, of Middlesbrough, before the North of England Gas Managers' Association.]

Nothwithstanding the many inventions intended to alleviate the lot of the gas stoker, and at the same time be made to pay their way in the working of our raw material—coal—there does not appear to be any one that may be said to be of universal, or even general, application. In several large works, stoking machinery has been introduced; but there are many similar works where one would suppose the conditions were equally favorable, but the managers of which appear to be holding back, I opine, till the perfect machine is invented, or, it may be, to note the fate of the later developments—inclined retorts, or other systems. I am of opinion that it depends greatly upon the treatment the various stoking devices receive at the hands of those working them, whether they turn out a success or otherwise; and, if so, one need not be surprised at the apparent hesitancy we note all round. What we should first of all determine is, is the principle of the machine or other appliance sound? If satisfied on this point, then I should say adopt it, and make certain that it is fairly worked out in its every detail. Steam or other power is bound in time to take the place of arduous hand labor, and I venture to assert that we would all hail the advent of any machine or system that would meet our requirements.

To day we are to consider the latest invention in the direction of automatic carbonization—viz., the Yeadon revolving retort, in which we have some novel features presented. The retort, about 7 feet of which is exposed to the fire, is conical in form, and is made of cast iron, revolving, on a horizontal axis, about three turns per minute. The diameter of the heated part is about 2 feet 6 inches at the feeding end, and 3 feet 6 inches at the discharging end. Cast solid with the retort are four feathers, which, in revolving, constantly keep the coals stirred. An external ring rib is cast on, to strengthen the body of the retort which is exposed to heat. There are stuffing boxes with asbestos packing in the stationary part at either end. Means are also taken to prevent indraught of air into the furnace, by having segmental strips of iron close to the revolving retort. Plain rollers, revolving in water trough castings, support the retort at the feeding end; while at the discharging end the rollers are V shape, to keep the retort in its position longitudinally—the expansion caused by the heating taking place at the feeding end, where provision is also made in the driving pinion being more than double the width of the wheel attached to the retort. The stuffing box at the feeding end is also elongated, to allow of expansion; and jets of water play on the packing, for cooling and lubrication. At the feeding end is a hopper, kept constantly full of the coal, which in turn is forced into the smaller end of the retort by blades fixed spirally on the shaft. The coal drops from the end of the pipe into the retort, which, being conical and revolving (with internal feathers), is made to travel automatically to the larger end, where the cinder falls into a recess, from which it is discharged by similar spiral blades. The coal can be automatically fed by conveyers into the hopper, and the cinder may be taken away by similar conveyers. A small engine (about 1-horse power) drives a shaft on which are a pair of bevel wheels, which communicate motion to a longitudinal shaft parallel to the retort. On this shaft are two pinions gearing into large wheels—one fixed near either end of the retort. On the first motion is a pulley on a countershaft, with a cone driving another with a worm and wheel on the shaft, with spiral blades feeding the coal into the retort. At the larger end, the longitudinal shaft, by means of bevel gearing, drives the discharging spiral blades. The elevators and conveyers can also be driven from the same range of shafting. There may be one or more retorts set in a bed, and heated by an ordinary furnace or by regenerative firing, as may be found most convenient. The gas produced is taken off at the larger end of the retort by the usual exhauster arrangements; the vacuum inside the retort being regulated, so as to prevent the possible escape of gas or indraught of air. The closely packed coal at the charging end, and the similar tightness of the cinder, keeps the retort practically closed, if there be not too great variation caused in the range of vacuum by the exhauster.

One of the chief merits of this system is that the coal, being constantly kept in motion by the revolving action of the retort, is made to give up its gases in a very short time (some 12 minutes being sufficient), instead of, as at present, extracting the gas, etc., by first spreading the coal in layers, and subjecting the inert masses to heat for 6 hours. Another advantage of keeping the coal in motion is that this form of retort is particularly adapted for carbonizing the very smallest, and consequently the cheapest coals, which many works reject at present as being unsuitable for the purpose of gas making with the ordinary retorts. It also appears that, in the Yeadon retort, not only is the gas, in the ordi-

nary sense, obtained, but the tarry and other matters, which we find in our liquor wells, are also converted into useful gas, and this of a higher illuminating value. As an evidence of this, it may be stated that, from experiments which have been made, some 2,000 cubic feet of gas per ton more in quantity, and 2 candle power increase in quality, have been evolved.

By thus volatilizing at one process all the available illuminants, you will be prepared to learn that the remaining tar, etc., is of decreased value. But not only is this the case with the liquid matters, but the solid residue, or cinder, is also useless as coke. (It appears, however, that other uses are being found for it.) So that there is a *total* destructive distillation of the coal in this mode of carbonizing. We have thus a new set of commercial conditions set up.

It will naturally be asked: "What relationship is there between the gain in sperm value and the loss from the non production of coke, and the values usually obtained in present working?" We should, however, first take notice of the question of labor, which is practically all, or nearly all, accomplished by the machinery, the mere attendance on which may be said to be all that is necessary—the hard manual labor being dispensed with, except for keeping up the heats, and for this it is proposed that gaseous firing would be introduced. On the other hand, there is the first cost of the machinery, and also the wear and tear, to be taken into account. But when it is considered that a revolving retort is capable of producing five to seven times the quantity of gas from a greatly less consumption of fuel in the furnace, and that it occupies less ground space, it will be conceded that there may be even less expense under this head than at present.

As the retort has only been working experimentally, at frequent intervals, during the past two years and a half, and as it is not now so capable, on this account, of being worked to the same advantage, we do not have exact working data; but the following may perhaps be taken as a sufficiently near estimate of the difference of cost per ton, comparing the present working with the revolving retort:

			Per Ton.
Gain.—In using the smaller kinds of gas-producing coal			1s. 6d.
In labor—			
Carbonizing at present costs.....	3s. 0d.		
Say, for revolving retort	1 0		
		2 0	
2,000 cubic feet of gas (say) at 2s.....		4 0	
2-candle power beyond 16 candles (say) at 3d...		0 6	
Total gain.....		8 0	
Loss.—Coke (say) 8½ cwt. at 6d...	4s. 3d.		
Difference of tar, etc , values	0 9		
		5 0	
Balance in favor of revolving retort.....		3 0	

This statement would necessarily vary in different works, and such allowances could be made on the items mentioned.

As to the other advantages of the retort in question, it may be thought that the want of coke production is in the reverse ratio; but doubtless—if one may judge by recent experiences—it would have been a good rid dance to be clear of a large proportion of the coke made by the ordinary means, as thousands of tons have been stocked at great expense, and after all a very low price had to be taken for it. Tar and liquor, too, have been a drug in the market for some years. A restriction in their production might have a beneficial effect on our getting something like the intrinsic value—if such a term can be applied in that sense—instead of only about one third of that.

Generally, the result of the adoption of such a retort as described, would be that about half the quantity of gas (say) during the winter season, could be made on this principle. This might involve that another class of labor for carbonizing would be employed in the busy season—leaving the regular hands practically undisturbed all the year round, or *vice versa*. Supposing a good stock of coke were remaining in the spring, the revolving retorts may be kept going, or otherwise, as the circumstances of labor, etc., may determine. In a word, it would put us in possession of the proverbial "two strings" to our "bow;" and, in our particular case, this other string has long been a "felt want" in these later days.

There is yet another phase in which we ought to look favorably on this invention. I refer to its applicability for reburning spent gas lime. A retort that could at pleasure be made to either manufacture great quantities of gas, or turn to a useful purpose that which is so much waste, would be a very great boon in many works. It is well known that lime can be reburned; and it has only been for want of the means whereby this could be readily accomplished which has deprived many managers from devoting special plant to the purpose. The revolving retort would thus be a very economic appliance; and we await with confident expectation its being fully adapted and further tested in our interests. Its future development will be eagerly looked forward to; and machines should now be put in practical operation at various gas works, where all the details of working—both for coal and spent lime—would be carefully noted, to guide those who may apply the system as a permanent installation.

Discussion.

Mr. W. Ford (Stockton) said they had all listened with pleasure to Mr. Terrace's paper. It had been short and to the purpose. He thought the author had not missed a point in favor of this apparatus; but one's mind could see a very considerable number of objections that Mr. Terrace had not touched upon. He must confess that, when he went to see the apparatus, he went with a mind prejudiced against its likelihood of ever being introduced as an element of success in gas manufacture. But, from further experience in the examination of the appliance, he had come to believe that there was something in it; and it only remained, in his opinion, to confirm what Mr. Terrace had said in his paper—that there should be a practical application of it in some gas works, under practical gas management. The experiments which had been made were, no doubt, very good; but an apparatus of this description, when it was put to everyday work, would be either of great advantage to them, or it would be thrown on the scrap heap, as, in his experience, so many of the inventions that had been brought before them during the last 35 years had been. Some of those had gone to their own account, without having left any result; but in this apparatus he saw a future, provided the practical objections which in his eyes remained could be removed. He might say that, like Mr. Terrace, he had had the advantage of seeing the appliance at work; and one thing which struck him against its introduction was the question whether it could be demonstrated in practice that it could be worked continuously. He must hesitate in believing that this had yet been demonstrated. The fact of its being worked at intervals was in favor of the process; but it had yet to be shown that it was capable of running the seven days of the week, granting even that a small space of time were allowed each day to recoup, because they must understand that the coal was going in continuously, and there was no rest. It was always green coal that was running in; and they all knew what was the effect of putting coal into a retort, with reference to the heat. There was one advantage of this process, and it was that they could "lay it off" on the Saturday night, and come back an hour or two earlier on the Monday morning and start it again. This was a great advantage, because, as all present were aware, the troubles with their men arose with those who came in for three or four months in the winter. The steady old stoker they had all the year round was not inclined to agitate; while the other man only wanted all he could get out of them for the two or three months' work he gave. The machine looked complicated; but he must say that any gentleman who saw it at work would come to the same opinion that he did—that it was much simpler than it appeared on paper. Taking it for granted that the coal was to be a gas producing coal, he was at one with Mr. Terrace in his statement that they might save 1s. 6d. per ton. There was no doubt that the smaller the coal the better this apparatus would work it. There was with it none of that great heat and labor which they had even in stoking machines. He did not think the heat was quite done away with in those machines. It might be that the inclined retort system would be of much advantage in that way. Of this he had had no experience; but they hoped to hear before long Mr. Terrace's views on the subject. There was, he thought, not the slightest doubt that the loss of tar would not be to their advantage. He believed that for the tar destructively distilled in this process, they did not have the proper proportion in value either of gas or illuminant. This might be accounted for to some extent by the state of the retort as they found it. It was very old—two years and a half; and they all knew (at least the older members did, who had had experience in the working of iron retorts) that when they once began to give way they were very difficult to patch up. This was a matter that would be easily overcome; and the very fact of this retort having been heated up 50 or 60 times a year showed there must be something in it. With it, they could start to make gas in a few hours. Suppose a London fog came on, what a great advantage this apparatus would be to a London Gas Company if they had 100 or so of them in reserve. Fancy the quantity of gas that could be evolved from this retort in a few hours! It was capable of doing the work of 28 ordinary retorts; and they knew the time it took to light up 28 retorts by the usual process. The fog might come and go again before they were ready for work; but with this apparatus they would have the gas gen-

erated and sent into the holder in a few hours' time. There was really no mechanical difficulty that he could see in the process; and all he wished was that it should be adopted in some gas works, and put to practical work during the coming season.

Mr. T. Bower (West Hartlepool) said he went to Leeds with Mr. Ford and Mr. Terrace, to see the invention they had heard described. When he saw the apparatus at work, his first impression was that there was something very novel in it, and something, as he thought, which was a decided improvement upon anything hitherto introduced. But, on further investigation, several things occurred to him which it might not be desirable to adopt. He believed, however, it was the intention of the patentees to make considerable improvements in the apparatus. One point which struck him was that which Mr. Terrace had mentioned, as to the admission of air into the retort. Means were, he believed, to be taken to mitigate this as much as possible; but it seemed to him that, in those openings, they had a source of evil which might be very serious, and which, if not carefully kept in check, might seriously affect the results. He agreed with Mr. Ford as to the working of the apparatus. One of the greatest advantages of the retort was its being capable of being started on very short notice, for temporary purposes such as fog. When he reached home, he carefully thought over the matter, and began to work out some results, and to compare them with those which he was getting by the ordinary process; and he was free to confess that he underwent a further conversion in the matter. Mr. Terrace had quoted some figures which, he was quite sure, were given with the best intention; and, he had no doubt, they were based on facts he had before him. He first of all gave them a saving of 1s. 6d. per ton of coal, by reason of their being able to use small coal. Many of the members would bear him out, he thought, that the average difference in cost between screened and unscreened coal, generally speaking, was something like 1s. per ton. This being so, those of them who were in the habit of using all screened coal, if they could by the introduction of this retort use unscreened coal, might possibly save more than 1s. per ton. In his own case, where the bulk of the coal they carbonized was unscreened, he failed to see that he would get even this saving; and how the 1s. 6d. came in was not very clear. He might, however, be told that they would be able to use an inferior class of coal. Well, if this were so, necessarily the results they would obtain would be inferior to those realized with a good class of coal. He also thought that a saving of 3s. per ton upon labor was rather high, judging from his own results.

Mr. Terrace pointed out that his statement was 2s. per ton.

Mr. Bower said the saving would vary very materially according to the rate which was paid for labor. If they had a high rate the saving must necessarily be very much greater than where they had stokers' wages down to 4s. per day. But the item to which he took most exception was that of the additional 2,000 cubic feet of gas at 2s. per 1,000 cubic feet. What seemed to him to be rather contrary with regard to this was that Mr. Terrace was in the happy position of being able to sell gas at 2s. per 1,000 cubic feet; and if he were only getting 2,000 cubic feet extra, at 2s., how was he to recover the cost of distribution, the contribution to the sinking fund, and the profits which he so generously handed over to the borough funds for other purposes? If he were only to obtain a saving of 2s. per 1,000 cubic feet into the gasholder, it would seem to him that the figure was altogether too high to make a comparison of that sort. For his own part, he should have put it at half the amount, because he was afraid that, if all the gas produced in the North of England cost 1s. per 1,000 cubic feet into the gasholder at all times, dividends would be very scarce. As to the use of the apparatus for spent lime, he decidedly thought there was something in the future for the appliance for that purpose. It appeared to him that it was particularly suited for revivifying spent lime; and if he should, at any future time, ever be induced to look into the matter with a view to experiment, he should think this would be one of the greatest factors that would influence him to introduce it, rather than to adopt it, in the first instance, for the distillation of coal. There were several other matters Mr. Terrace had touched upon and given an able explanation of; but it seemed to him, as Mr. Ford had said, from the fact that the results were obtained during a process of carbonization extending over (say) not more than 30 minutes, that they might be very different from what would be realized if the plant had to work for 24 hours or for a week. This was a point which could only be settled by some gas manager getting the plant introduced into his own works, and giving it a fair trial under the usual conditions; and he was in hopes that some of their friends—perhaps Mr. Terrace or Mr. Ford—would, if they were so sanguine of the results, before long introduce it in their works and give their brethren the benefit of their experience.

Mr. J. Hepworth was sure the Association would be the first to welcome any efforts that were made with a view to reducing the cost of labor in gas works, or ameliorating the conditions which existed with reference to the labor that attached to the operation of stoking. He had listened very carefully to Mr. Terrace's paper, and he thought there were some striking omissions, although it contained a great many facts and statements which were extremely interesting, but which were open to very much criticism. He did not hear any reference made to the cost of the installation itself. The first cost was a primary matter to consider when they came to make deductions as to the saving to be obtained by the introduction of the process. He dissented—in a friendly manner, of course—from some of the statements which were made in the paper as to the saving, in the first place, upon the cost of coal. He should think it quite possible that 1s. 6d. or 1s. might very well be saved. But, if he understood the apparatus aright, they would be compelled to use small coal. If they had coal which contained large nodules, they would be obliged to separate these larger pieces, and to do this they must either commence screening or have a grinding process for reducing the coal to one size. The outlay for this would have to go against the 1s. 6d. or 1s. saved in the first cost of the coal. Then he did not agree with the figures given as to the cost of increasing the value of the gas. It was claimed in the paper that the quality of the gas was enriched to the extent of something like 2 candles; and Mr. Terrace had stated that about 3d. per candle would be the cost by the ordinary process. Well, he had to enrich gas; but he would not say that it cost him 3d. per candle. A less figure than that should be taken. He was a little dubious about the 2,000 cubic feet extra per ton of coal, though he was sure that anything which Mr. Terrace told them would be quite substantiated by his own experience. The sources of damage by the introduction of air had already been pointed out, and one was glad to hear that means were to be taken to prevent such a serious matter. With reference to the continuous working of a retort like this, there would be some danger in having to let down the heat, because of the delicate joints. The apparatus could never be thoroughly tested until it was put into a gas works, and operated continuously during the six or seven days of a week. If this were done, the figures which had been given them would have to undergo very considerable revision. With reference to the use of the apparatus for revivifying spent lime, it seemed to him that it would be excellent for the purpose; but, unless it could be done by this process very much cheaper than by other processes, he did not know that it would be of much value. Where they could get lime at 10s. per ton, the apparatus must be a very effective and very cheap one to pay interest on capital, and for the labor involved in revivifying a cheap material like that.

Mr. W. J. Warner (South Shields) thought it was due to Mr. Terrace that he should, on behalf of the Committee, say one word with reference to the data that gentleman had submitted that day. It was the author's desire to have fuller and more reliable data to put before them, and to some little extent he hesitated in presenting the paper without data more satisfactory than those he had had to rely upon. But the Committee pressed him to bring the paper before the Association. He had done his best, and he (Mr. Warner) considered they could not do otherwise than admit that the result had been satisfactory.

Mr. Sayer (Harrogate) said that, having heard the paper and seen some of the experiments conducted with the apparatus, he would just add his testimony that he thought those who had not had the pleasure of investigating the process would find it was something of an "eye-opener" to them, although it was in a form in which the results could scarcely be taken as what would be obtained in practical working. But even in the form in which it was, it was a very decided advance in the distillation of coal.

Mr. B. W. Richardson (Harrogate) asked what quantity of residual cinders was obtained per ton of coal.

Mr. C. D. Drury (Sunderland) remarked that he had not seen the retort, and would like to put a few questions. One was at what temperature the apparatus worked, and also as to the probable life of it. He also wished to know what amount of the area of the retort was occupied by the charge, because unless the area were pretty well occupied he should imagine that stopped pipes would frequently occur. From what he had heard, he supposed that Mr. Terrace would not recommend an installation of these retorts by themselves, but only as an auxiliary to the ordinary retorts.

Mr. Terrace, replying to the points raised in the discussion, said Mr. Ford had stated some practical objections which he saw, but these were necessarily details, which would be rectified in future apparatus. There was no doubt the appliance was not perfect. As to continuous use, it was a question as to whether it would be better to be always working. He thought, indeed, that a retort was always best when it was contin-

uously in operation. This retort had been working, not for 30 minutes, but for 16 hours at a stretch. The gas was given off by it in 12½ minutes; but they had never had a test which lasted less than two hours. It was a question of heats whether the coal would all require to be of one size. It was impossible to tell by a single retort, exposed to wind and rain; and it would be too bad to throttle an invention of this kind by a single instance, But, if sufficient heat were applied, he thought they could look for the results. The trend of his paper was that the retort would be an auxiliary, and the figures he gave were tentative. The saving of 3s. which Mr. Bower commented upon was the total gain, of which 1s. was from labor. They would not have any outlay upon the 2,000 cubic feet of gas they gained out of the same coal. He thought that the main thing was to get the 2,000 cubic feet, and that they would all be very pleased to have it. The cost at the holders was a question which, in his opinion, they need scarcely mix up with this one; it was carbonization they had to do with. Of course, Mr. Bower was quite right in saying that the 2s. for the 2,000 cubic feet was not all gain. As to screened and unscreened coal, what he alluded to was not unscreened coal at all; it was "duff" coal—small coal. He referred to the small coal, but not necessarily inferior coal, though coal which there was difficulty at present in carbonizing. Mr. Hepworth made some reference to the cost of the apparatus. This, he believed, would be something like £600, or about equivalent to the cost of a through bed of retorts. He merely mentioned the matter in a very tentative way in his paper, because he did not pretend to go into many particulars. Mr. Hepworth also alluded to the grinding of the coal. Of course, this would require to be done, because the spiral would not deal with large lumps; but it was necessary to do this for ordinary stoking machines. The temperature at which the retort was used was just what they would expect an iron retort to be worked at—perhaps up to 1,500°. They had to heat according to the material they were carbonizing. When they were passing coal continuously through it they could easily regulate the heat. The area of the charge would simply be greater or less according to the heat they had externally. There was about the same weight of cinders—about 8 cwt. per ton—although, as he said, they were useless, and therefore he took no notice of them.

The President said he confessed he could not see himself where the 1s. 6d. per ton might be saved by using either "duff" or the single screened coal, which would be suitable for this apparatus.

Relations Between Electrical and Insurance Interests.

[Read by Mr. Jas. A. Waterworth before the St. Louis Electric Club.]

In discussing the relations between electrical and fire insurance interests I speak as the local representative of one species of invested capital addressing the representatives of the other. The two interests are free and equal. They are subject to the same fundamental laws, governed by the same principles, operated under the same necessary conditions. With both self-preservation is the first law. The permanent prosperity of both, however, depends also on observing the laws of comity with all their kind. This is the broad general relation they hold to each other, and to every species of invested capital—the relation of independent life and independent prosperity. Invested capital cannot escape from the mutuality of the relation; it cannot violate it in any of its forms and prosper for any length of time.

To come down from general principles to the personal relations of the two interests at that point where the practical details of electrical work meet the practical details of insurance, the point of contact and of friction, let us examine the two interests. They are free; each has its own special field; neither is in any wise subordinate to the other; each is possessed of the inalienable right of self-preservation. And yet they are not independent of each other. There is a common ground on which they are compelled to meet and act, a point at which there is a common interest and at which they can mutually serve or mutually injure each other. At this point the solitary law of self-preservation is inadequate, and if alone would breed strife and loss. At this point, as on every common ground of human action, the law of comity—the law under which men agree to live and thrive together—furnishes the basis of their mutual relations, and accordingly as they occupy this ground intelligently and peaceably in like proportion will they occupy it successfully. Let us look at this common ground of operation for a moment.

It is the lot of fire insurance companies to pay for all the improvements and experiments. This does not appear to be quite right; nevertheless public opinion seems to be agreed that this class of losses, due mainly to ignorance and incompetence, should be charged up to insurance. It has been the greatest aid to progress the world has ever known, and has paid hundreds of millions to keep the industries of this country abreast of the times. It is a great, if involuntary, benefactor; but it can hardly be be wondered at if under the circumstances the instinct of self-preservation is powerfully developed in the insurance interests.

Electricity was the latest novelty that presented itself to the conservative eye of insurance. The new comer did not make a favorable impression. It was a new and ubiquitous force; it was reported by its best friends to be erratic, whimsical and even dangerous. It was known that it would burn; it was said that it would kill, and it was believed that nobody knew much about it. It was popularly supposed that it took a conjunction of chemist and civil engineer to wire a building so that life and property would be safe. The coming king stepped on the stage with the reputation of an incendiary and anarchist. He claimed the right to enter every house and bring his incendiary habits with him. It was claimed that he could be permitted to enter and remain in a building with reasonable safety if—and here the electrical interests and the insurance interests met. Who was to decide under what conditions electricity could be introduced into our warehouses, factories and homes with reasonable security against setting the town on fire. Electricity brought with it a motley multitude of hangers on and a foreign nomenclature. A new class of men, known as experts, seemed to spring like an exhalation out of all sorts of occupations—out of tinners' shops and plumbers' stores and out of boiler and engine rooms. These men knew nothing about electricity, but they soon learned to patter about volts and amperes and short circuits, and they paralyzed the boldest citizen with these and such like cabalistic expressions. They spoke with authority and claimed the right to decide what was safe and what was unsafe. In 1888 it took about three weeks to convert a mechanic into an electrical expert. The sudden growth of expert talent beat the record of Jonah's gourd. By a merciful dispensation the expert fungus perished as it had come—in a night. But while these men were contracting and doing work you may readily suppose they did not commend electricity to insurance companies as a harmless innovation. Some of the work done by them would make your hair stand on end. It is being condemned and taken out wherever found, often at great cost.

The insurance agent is rarely more than ten years in advance of the community in scientific matters, and I confess that he didn't know a bit more about electricity than the electrical expert. He wasn't so much scared by the electricity as he was by the expert talent. The insurance companies were scared, however. Whatever else they might or might not know about electricity, they knew they had to pay for it. They were right; they paid at once for the first central station in St. Louis—the Brush on Walnut street—and then they were sure that electricity was an incendiary of the first order. Do you blame them? I think that at that time, omitting a few men of technical education, there wasn't a man or boy, not even an insurance agent, in St. Louis that knew anything definite or practically useful about electricity; and much of the installation at that time was done by ignorant and incompetent men. That was the situation in the beginning, and I think the insurance companies were justified in keeping the law and practice of self-preservation well to the front. I am also free to say that I believe the situation in St. Louis was practically the situation in every city and town in the United States at the first introduction of the great modern power; it was in grossly incompetent hands. Everywhere throughout the country property was being burned by imperfect electrical work. With every temptation to do it the insurance interests in St. Louis did not set themselves up as dictators to the electrical interests or take any advantage of the situation. From the start they clearly recognized and admitted: First, that they were face to face with the coming motive and illuminating power; second, that the electrical interest was clothed as fully as themselves with the instinct and right of self-preservation, and third, that the law of comity or profitable living and working together was the only law fairly applicable to the situation. The first set of rules governing electric installations was presented and recommended by a St. Louis electrician, who urged its adoption in the interests of the electrical business in St. Louis, and to restrain the conscienceless competition of ignorant and incompetent contractors. They were adopted for the mutual benefit of both interests, and the board set its best inspector to work to educate himself sufficiently to inspect the work done under the rules. These rules have been amended since by the joint action of insurance companies and electricians—your own body passing on the last edition. What has been attained in the last six years in perfection and safety of installation, in intelligence and competency of inspection, we have grown up to; we have educated ourselves up to; we have moved thereto with equal step. There is no place for the claims of small precedences in this business. The more scientific we are the humbler we shall surely be, for we know, and if we don't know our neighbors will remind us, from what depths of ignorance and with what painful effort

we have climbed to the small eminence on which we stand, appropriating the discoveries of the very great investigators as fast as made, and growing great on what we fed on.

A prominent consideration determining the relations of the two interests is the authority, assumed or conceded, of making inspections. This may easily be made a ground of dissatisfaction and strained relations. But a little common sense will, I think, settle the matter. That inspection and control of electric installation is necessary and desirable, and beneficial to all, I think, cannot be doubted. It is certainly necessary for the insurance interests, which have to pay for all the losses caused by its dangerous defects; it is necessary for the electrical interests, if the conscientious contractor is to have a show, and if the credit of the business and the public confidence in its safety are to be maintained; it is necessary for the light and power companies who need some test of the installations they supply, quite as much as the gas companies require a test of the gas pipes and fixtures they fill; and it is necessary for the public that it may quietly and securely enjoy the great modern boon of electric light and power. There may be and there is a question where this power of inspection and approval shall reside; with insurance, with electricians, or with the public. As the greatest disaster, in case of dangerous defects, falls upon the insurance interests, as they are never quit of the risk, while the contractor is discharged of liability on payment of his bills, and as the absence of the stimulus of direct personal interest tends to make the public official inspection superficial, the duty seems to have been wisely assumed by the insurance interest. It has most at stake. It would probably inspect on its own behalf in any case. If the general inspection be honestly administered to the benefit of all parties by this outside interest, which seeks only safety of installation, it is undoubtedly better to have it done by it, and to pay for having it done. As far as I am able to learn, there is no serious ground of complaint against inspection as at present conducted. Its rules and prices have been mutually agreed on, and the enforcement of the requirements has not been offensively made. The fruits of co-operating relations between the electrical and insurance interests in St. Louis are to be found on every hand. They are to be found, first, in the ability to secure the installation of any plant in the safest and most approved manner by harmonious action between us; second, in the fact, which I think is apparent, that St. Louis is the best wired and best fitted city in the United States; and third, is not this association itself, and this meeting, one of the fruits of harmonious relations? The survival of the best and strongest elements in the electrical business; the dying out of the mushroom expert; the training and education of the men who had the mental and moral powers fitting them to live—all this, I think, is attributable in part to the high standard of requirements adopted for electrical work and the harmonious relations that secured its application.

A curious proof of the thorough-going nature of the inspections in St. Louis was furnished in connection with a job done by a Chicago contractor in one of our largest stores. The requirements were well understood, and the understanding was positive, that the concealed work was not to be covered till it was inspected. But the inspector found the concealed work boxed up and the walls painted and decorated in fine style before the work had been inspected. The certificate was refused. The opening was to take place in a day or two. No threats nor objurgations of the Chicago man, who had never heard of such a high-handed proceeding in his life, nor even the entreaty of the merchant, the beauty of whose opening would be materially marred by tearing open the walls, could extort the certificate. We induced the merchant to stand firm and refuse payment till the certificate should be issued. The contractor was brought back from Chicago, the boxing was stripped off, and an incomplete, unsafe and skamped job stood revealed. It cost the fellow three days' work to make it right. When he got his certificate he swore he would not work in the town for $500 a month.

Whether electricity is a fire hazard when installed with all safeguards science can suggest is a question on which the two interests may not always agree; but I will say that in practice it has been decided in St. Louis in favor of the subtle fluid, which is admitted as an illuminator and as a power without charge for it as such. This would seem to remove the matter from the ground of a vexed question, and free the discussion of our relations from that issue. Undoubtedly from the insurance point of view the accumulation of many new and intense potencies, both of light, and power, and material—electricity among the rest—is forcing up the loss ratio of the country and slowly increasing the rates of insurance. There is none of us wise enough to put his finger on the amount, proportion or nature of this increase of the fire loss due to the universal use of electricity. Personally, I believe that in all its uses, when properly installed, it is an improvement over that which it has displaced. The sum of all these influences is one of the marks and concomitants of our present progress, and it would be more profitable to adjust ourselves to it than to protest against it. On this score insurance stands in precisely the same relation to the electrical interests that it does to all other interests and elements which enter into and create our fiery experience.

I am not competent, even at this late day, to talk electric talk to you, nor would I attempt it in this presence if I were. I know I know much less about electricity than I knew I knew five years ago. Probably some of you have had the same experience. It offers the vastest and richest field now open to human investigation; in its unexplored tracts it contains the largest elements of power, the mightiest factors of material prosperity, convenience, comfort, and civilization left for the enjoyment of the last ages; in its domain man will achieve wonders of discovery, and by its aid exhibit marvels of power beside which all that the puny past can show will shrink into insignificance. The world will become a neighborhood, and the unity of the race will be accomplished. Into these things I cannot expect to enter save by faith and reasonable expectation. But I can, from the height on which we now stand and with the prospect now within our ken, see enough to justify me in protesting against the paltry and narrow suggestion that, for any vain dream of temporary advantage or visionary profit, it would be wise or necessary that the great interests under consideration should adopt the law of self-preservation as the sole rule to govern their relations toward each other, and abandon that higher law of comity and mutual help under which they have hitherto lived and thrived together.

Gasfitting and Fatal Gas Accidents.

An English contemporary, in dealing with the related topics named in the heading, avers that the want of sound technical knowledge amongst the workmen in several trades which have what may be called a scientific foundation is remarkable. A few years ago the work done by plumbers was executed almost invariably in the most unsatisfactory manner. The men worked by what is called "rule of thumb," and had no real knowledge of the materials with which they worked, or of the requirements that they were to fulfill. As far as regards this trade, great improvements have been made, and the work which is now done by skilled and educated plumbers is creditable in the highest degree. It is not so, however, with the gasfitters, who, taken as a whole, appear to be extremely ignorant of the nature of the materials with which they have to deal. Gas, valuable as it is in the household and as a general illuminant, is most dangerous when it escapes from its proper surroundings; and it is singular that many of the most fatal accidents arising from its escape should happen to the gasfitters themselves.

A remarkable example of this is recounted in the papers of the present week. A gasfitter who, from his age, might have been supposed to have been some score of years or more working at his business, goes to sleep in his own bedroom, and is found in the morning with his wife, both unconscious and apparently dying. Removed to the hospital, he lives during the long period of 19 days, never thoroughly recovering his sensibility, eventually dying from softening of the brain produced by breathing for many hours air contaminated with poisonous coal gas. His wife also remained insensible for a week. The coroner, himself a physician, stated that it was rarely the case that medical men had the opportunity of watching the effect of long-continued breathing of coal gas, for the victims were generally dead when found. In this case the escape was so slight as not to awake the sleepers, who breathed the gas for many hours, until it permeated the whole system, producing insensibility in both cases, followed by softening of the brain and death in one.

This fatal accident arose from the steady escape of gas from a burner, and could not have happened had proper taps been employed. It is obvious that one or other of the sufferers, in turning off the light, had overturned the tap, and, instead of shutting off the gas, turned the handle so far around that it was opened again. Almost all the cheaply constructed gas cocks are made in this way. There is no stop pin which checks the hand in turning to prevent the tap being overturned, and thus reopened. It is most probable that this accident must have occurred in an utterly unventilated room. Had there been any access of fresh air from the door or window, which would have supplied a continuous current up the chimney, it is very doubtful whether the air would have become sufficiently impregnated with coal gas to have produced a fatal effect; but the customary absence of ventilation in sleeping rooms had on this occasion more than its usual injurious effect.

Fatal accidents to gasfitters, and still more frequently to other persons, constantly arise from ignorance and the extremely explosive nature of mixtures of gas and air. Instances are constantly on record of

workmen who regard themselves as competent going into rooms and other enclosed places with lights to seek for the source of the escape of gas, in place of first of all throwing open doors and windows to allow the explosive mixture to be carried off. In spite of the great familiarity with the use of gas, it is not too much to say that in almost all cases the manner in which it is used as an illuminant is faulty in the extreme. In the first place a much too high pressure, which varies from hour to hour, is allowed; this gives a flickering light, and prevents the due combustion of the gas. If argand burners are employed, the light, which is usually required below them, is obstructed by a large opaque gallery, causing a shadow beneath the gas. The glasses themselves are, generally speaking, double the height that they should be, producing such a strong current of air that the gas is "over burned," and gives out from 20 to 30 per cent. less light than it should do, producing heat and carbonic acid, overheating the air of the room, and rendering it unnecessarily impure. Even if improved burners are employed by those who call themselves skilled gas engineers, semi-opaque saucers are put beneath, which obstruct the passage of a large percentage of the light produced.

The situation selected for gas lights is usually the center of the room, where a large gasalier is suspended at as great a distance as practicable from the objects to be illuminated, the gas engineer, as the gentleman dubs himself, being apparently utterly unconscious that light diminishes inversely as the squares of the distance increase, and that 3 yards from a gas light only one-ninth of the light is received that falls on a similar object at 1 yard, and that at 4 yards only one-sixteenth. When the smaller flames are used, which are termed "fishtails," produced by 2 holed burners, these are almost invariably placed in the wrong position. They are constantly used with globes which are often opaque, obstructing nearly 50 per cent. of the light produced, with a small opening below and a large one above, which produces a current of air that renders the flame unsteady, flickering, and most injurious to the eyes, and they are rarely if ever placed in any but an upright position, giving infinitely less light downwards, where it is usually required, than if turned in a horizontal direction.

All persons must have noticed the brilliancy of what is called a "sunlight" when placed in a ceiling—an effective although extravagant light, from being so far away from the objects to be illuminated. The brilliancy of this arrangement depends upon the fishtail burners being placed horizontally; but to place a single fishtail burner in a room in a horizontal position appears to be an act of common sense of which few gasfitters are capable. In this and numerous other modes gas is consumed in unnecessary quantity, much more being burned than is wanted to obtain a due proportion of the light required.

This is an evil not merely on the score of economy, but on that of health and comfort. The more gas that is burned in a room the greater is the amount of carbonic acid that is produced, the more deleterious does the air become that is breathed by the occupants; for, although the gas may be burned so as not to produce the amount of light that it is capable of doing, it cannot be consumed without producing a normal amount of heat, so the air not only becomes impure, but very much overheated. Then, again, the more gas that is burned the greater is the amount of moisture that is produced by its combustion. This amount is really very great. It may be seen in the windows of close shops streaming down the inner surface when condensed by the cold air of winter, and it is evident in those gas stoves where the moisture is condensed. But, unfortunately, the moisture is not all, as the whole of the poisonous carbonic acid escapes into the atmosphere, rendering gas stoves without a flue in all cases injurious in closed rooms. To avoid all these evils, let us hope that the gasfitters, like the plumbers, may be eventually brought under education and registration.

Identity of Light and Electricity.

Mr. E. S. Ferry, in a note on this subject, remarks that from the experiments recently performed in electrical oscillations, the conclusion that light and electrical oscillations are identical is very strongly substantiated. The principal parts in which they practically agree are the velocity, rectilinear propagation, laws of reflection, interference, refraction, polarization and absorption by material substances. In fact, the sole certain difference appears to be the wave length. There is difficulty in producing continuous electrical oscillations of less than a foot in length, while light is about the hundred thousandth part of an inch. The only difference between them is that our eyes will appreciate the short ones, but are not affected by the long ones. The great question for electrical engineers is to produce these very short wave lengths directly. Hertz by the induction coil and condenser, and Tesla with a specially designed multipolar dynamo, have produced similar waves, which will set molecules in a rarefied atmosphere into such rapid vibration as to produce light. But the great question has advanced only one step. Probably neither of these methods will furnish more than a suggestion to the real solution. A simple computation will show that by the Hertz method, in order to produce directly vibrations capable of affecting the retina, the condenser would be of nearly molecular size; on the other hand, by the Tesla method, the dynamo necessary would be a mechanical impossibility. However, the outlook is encouraging, and any work done along these lines cannot be otherwise than of benefit to science and to practical engineering.

In the domain of wireless telegraphy this subject is of prime importance. Much has already been done in this direction, and much more will undoubtedly be done by the aid of electrical oscillations of high power and frequency. The Edison method of telegraphing from moving trains is probably the best known practical application of electrical oscillations in air to commercial practice. Betts' method of telegraphing between ships at sea is another well known application, and depends upon the transmissibility of electrical oscillations through water. Although these methods are far from perfect, the end seems not distant, and we can confidently expect that in the near future we will be able to telegraph on land and sea without wires with great ease by means of electrical oscillations of high power and frequency.

An Expert English Opinion on Certain Oil Gas Processes.

The following is an abstract of a report returned to the Edinburgh and Leith Gas Commission, by their Engineer, Mr. F. T. C. Linton, who had been instructed to inquire into the subject of the "Manufacture of Gas from Oil":

I had an opportunity last year of inspecting the various processes for the manufacture of gas from oil in course of being experimented with at several of the gas works in London; and I have also had full information regarding these processes. I have further had an opportunity this year of carefully inspecting the process invented by Mr. Wm. Young, which has been in operation for some time at the Peebles gas works. As sanctioned by the Sub-Committee of the Commissioners, Mr. Walker, Assistant Engineer at Leith, was also sent to Peebles for three days (accompanied by the assistant at the Edinburgh works), and made careful notes of the apparatus and methods of working, the quantities of materials used, and the quantity and quality of the gas obtained, etc.; and the results of the notes are embodied in the information given in the appendix to this report. There is also given a statement of the working results of the Peebles gas works for the months of November, December and January last; and, as these are fully borne out by those arrived at by ourselves, they can evidently be depended upon as being about correct. I have also had an opportunity this week of seeing the Alexander-Paterson process of the Patent Paraffine Gas Lighting Company of Glasgow; and notes regarding it are also given in the appendix.

The various processes hitherto in use for the gasification of mineral oils may be conveniently classified under one or other of the following heads:

(1) Those in which the oil is dealt with at one operation by being run into a retort maintained at a temperature of not less than 1,500° to 1,600° F. Pintsch's system may be taken as an illustration of this class, where the products per gallon of oil are about 80 cubic feet of gas of 60-candle power, with a quantity of thin black tar, and a small amount of carbon deposited in the retort. The gas is permanent in character, and withstands compression well; hence its use for the lighting of railway carriages. It is found, however, that the process requires oil of a comparatively low specific gravity (.840 to .850), as whenever heavier oils are used, the retorts and apparatus rapidly become choked with a sooty carbonaceous deposit.

(2) Those in which the oil is gasified in presence of a large volume of a very poor or non-luminous gas, such as water gas. The Lowe system, which is very much used in America, and has also been tried in London, may be taken as typical of this method. By this system there is only one ultimate useful product, viz., gaseous hydrocarbons, which are carried off by the large volume of water gas; the excess carbon being burnt off as carbonic acid or carbonic oxide in one of the stages of the process. This method yields a higher illuminating value per gallon of oil than any of the methods in the first class; but, although very large installations have been made at gas works in London of the Lowe and kindred processes, the results both as to cost and as to the reliability of the processes to give a steady quality of gas, have not answered ex-

pectations. In America, where these processes are largely used, it must be remembered that coal gas is very dear, and oil at its cheapest, and that many things are put up with there which would not be tolerated in this country. It is also a great objection to the gas produced under these processes that it is so largely composed of the deadly poison, carbonic oxide gas.

There is another process used in London, whereby the gas made from English coking coal is raised from its normal illuminating value of about 15½-candle power to 16½ candle power; thereby enabling it to comply with the parliamentary standard for London, of 16 candles. This is done by vaporizing, by steam, a very light spirit, and mixing a small proportion of it with the common gas; but this is not a making of gas from oil, as the spirit is simply resolved into a vapor, which is carried along with the common gas. It saves the use of cannel coal for the same purpose; but it cannot be mixed with common gas in larger proportion than will raise the quality by from 1 to 1½ candles, and it is of no practical interest in Scotch gas works.

The method of oil gasification introduced by Mr. Young, and now in operation at Peebles, differs so considerably from any of the processes already described that it may be looked upon as a perfectly distinct system; and it embraces several principles which are novel. Briefly described, the process consists of a very gradual gasification of the oil by means of a *radiant* heat at a comparatively low temperature, and the scrubbing of the gas and oil vapors given off by the oil which is ultimately to be converted into gas. The oil vapors are condensed and returned again and again to the retorts along with the supply of fresh oil, till the whole is resolved into permanent gas of very high quality, and a quantity of very fine pure coke (very similar to still coke), equal to 5 cwt. per ton of oil used. It is found that, of the oil run into the retort at any one time, one-sixth is resolved into permanent gas, and five-sixths into oil vapors, which are condensed, and again returned to the retorts.

Generally speaking, the process appears to be a complete solution of the difficulty hitherto experienced in using heavy mineral oil gas for gas making. The plant is not expensive; being practically the same, as respects cost, as that which would be required for producing a similar quantity of coal gas—the make of gas per retort being about the same for both. The charge for repairs and maintenance would be considerably less than for coal gas plant, as the working temperature is so much less; and the heavy wear and tear in coal gas retorts, due to the drawing and charging every three hours, does not arise with oil gas retorts, except to the very small extent involved in withdrawing the coke once a day. The oil gas is, besides, almost entirely free from sulphur or other impurity; so that the cost for purification would be very trifling as compared with coal gas. The process is also easily controlled, as, by increasing or diminishing the rate at which the oil circulates, the temperature (which outside the retort is from about 1,180° to 1,330° F., and inside from about 900° to 1,000° F. when the retort is in operation) can be rapidly modified, and this without any deleterious effect on the ultimate result; and therein lies one of the advantages of the process. In the old process of rapid and direct gasification, the exit pipe from the retort, as well as the apparatus generally, is very liable to become choked with a carbonaceous deposit if the heat be too high, and especially when oil of high gravity is used; but, in Mr. Young's process, the introduction of the oil into the upstanding exit pipe obviates this difficulty, as, if any signs of an obstruction are observed, it is merely necessary to quicken the circulation of the oil, when the carbon is washed down into the retort. Another great advantage is that any kind of oil can be dealt with by the process; and the tar from coal gas manufacture could be equally well utilized by it, and made into gas. When the tar falls to such a low price as has been the case recently, it might be more profitable to make it into gas than to sell it; and in any case, by so doing, and limiting the output of tar, a higher price would probably be maintained. With the other processes, every kind of oil would not be suitable.

The results obtained, as shown in the appendix, are far in advance of those from any of the other processes now in use. Professor Lewes, in a paper read before the Institution of Gas Engineers last year, gave as the highest results with the best oils for the purpose—viz., Russian distillate and intermediate oil—76 to 80 cubic feet of 50 to 60 candle gas. This was when the oil was "cracked" alone, as in the first class of processes referred to in this report. When "cracked" in an atmosphere of inert gas, as in the second class of processes, he found an increase in results of about 27 per cent.—say, equal to about 80 cubic feet of 70-candle gas, which is equal to 1,120 candles per gallon. But the results obtained by Young's process (and with oils costing about 2d. per gallon, whereas those referred to cost about 4d. per gallon) were 88.76 cubic feet of 90.59 candle gas, taking the coal gas as being equal to 18 candles, which is equal to 1,578 candles per gallon; while, if our own analyses of the coal gas are taken—viz., 16 candle power—the results are 86.76 cubic feet of 100 candle gas, which is equal to 1,735 candles per gallon.

It will be desirable now to see how the process compares, as regards cost, with gas made from the high class coals with which, as an enricher, it has to compete; and also how the cost of a mixture of oil gas with gas from cheap splint coals compares with gas of a similar quality made from a mixture of cannel and splint coals. One gallon of oil in Mr. Young's process yields 86.76 cubic feet of gas, and the specific gravity of the oil being .885, there are 253.1 gallons per ton. The gas per ton is therefore 21,959 cubic feet; the illuminating value, as before stated, being 90.59 candles. This is equivalent to a value of 6,820 lbs. of sperm. Comparing this with the best cannel coals, such as No. 1 Arniston and Newbattle, which have a value of about 1,330 sperm candles per ton, each ton of oil gives results equal to 5½ tons of these coals. Taking two of the best cannels next to Arniston and Newbattle—viz., No. 1 Niddrie and Dryden—these have a value of about 1,176 lbs. of sperm per ton; and each ton of oil is therefore equivalent to 5½ tons of these coals. Taking, again, one of the best of the shaley cannels so largely used now for gas making—viz., Pirnie cannel—this is equal to about 1,230 lbs. of sperm per ton; so each ton of oil is equivalent to about 5½ tons of this coal.

Coming now to the cost of producing the gas, the question of charge for capital may be eliminated on both sides, because the plant required for both is practically identical in cost for a given make of gas. The charges for repairs and maintenance may also be left out, although these will undoubtedly be less for the oil than the coal plant. The following may therefore be taken as the relative charges incurred; bearing in mind, however, that the coal charges are for actual working, while those for oil gas, as regards oil, are a very full (possibly an excessive) estimate:

Cost of Gas from a Ton of Oil.

Oil, 1 ton	£2	0	0
Fuel for retorts, 12 cwt., at 7s. per ton	0	4	3
Labor and purification, at 3d. per 1,000 cubic feet	0	5	6
Charge for royalty	0	2	6
Total	£2	12	3
Deduct value of 5 cwt. of coke, which sells in Peebles at 20s. per ton, but say	0	2	6
Total	£2	9	9

Arniston and Newbattle coal are at present being delivered in Leith at 33s. and 33s. 6d. per ton. Taking them at the first figure, at which they have quite lately been sold, the charges for 5½ tons of the coal, which are of the equivalent value of a ton of oil, would be as follows:

5½ tons of cannel, at 33s. per ton	£8	9	1½
Labor and purification, at 7s. per ton	1	15	10
Total	£10	4	11½
Deduct value of salable coke, after providing fuel for heating the retorts, 36 cwt., at 7s. per ton, 12s. 7d.; do. liquid residuals at 1s. 8d. per ton of coal, 8s. 6½d.	1	1	1½
Total	£9	3	10

Or, taking these coals at the lowest price at which they have ever been sold—viz., 18s. per ton (in 1888):

5½ tons of cannel, at 18s. per ton	£4	12	3
Labor and purification	1	15	10
Total	£6	8	1
Deduct salable coke and liquid residuals, as above	1	1	1½
Total	£5	6	11½

No. 1 Niddrie and Dryden are at present being delivered in Leith at 28s. 3d. a ton. The charges of the equivalent of a ton of oil will be:

5½ tons of cannel, at 28s. 3d. per ton	£8	3	10
Labor and purification, at 7s. per ton	2	0	7
Total	£10	4	5
Deduct value of salable coke, 2 tons, at 7s., 14s.; do. liquid residuals, 9s. 8d	1	3	8
Total	£9	0	9

Or, taking these coals at the lowest they have ever been sold for—viz., 13s. 1d. per ton (in 1888):

5½ tons of cannel, at 13s. 1d. per ton	£3	15	10½
Labor and purification	2	0	7
	£5	16	5½
Deduct salable coke and liquid residuals, as above	1	3	8
Total	£4	12	9½

Pirnie cannel is at present being delivered in Leith at 18s. 4d. per ton. The charge for the equivalent of 1 ton of oil—viz., 5½ tons of coal—will be:

5½ tons of cannel, at 18s. 4d. per ton	£5	0	10
Fuel for firing retorts, 23 cwt., at 7s. per ton	0	8	1
Labor and purification, at 7s. per ton	1	18	6
	£7	7	5
Deduct return for residuals, at 1s. 8d. per ton	0	9	2
Total	£6	18	3

Or, taking this coal at the lowest price at which it has ever been sold—viz., 12s per ton (in 1888):

5½ tons of cannel, at 12s. per ton	£3	6	0
Fuel for firing, as above	0	8	1
Labor and purification	1	18	6
	£5	12	7
Deduct return for residuals, at 1s. 8d. per ton	0	9	2
Total	£5	3	5

Summarizing these calculations, the relative costs for the same amount of illuminating value are:

Oil				£2	9	9
	Present Prices.			At Lowest Prices Known.		
Arniston and Newbattle cannel	£9	3	10	£5	6	11½
Niddrie and Dryden	9	0	9	4	12	9½
Pirnie	6	18	3	5	3	5

It appears, therefore, that gas from high class cannels at current prices costs from three to four times as much for a given illuminating value as oil gas produced by Mr. Young's process; also that, at the lowest prices ever known for cannel coals, it costs about twice as much. Or, to put it another way, the price of oil might be raised from 40s. to 80s. per ton, and the oil gas would still be fully cheaper than gas from high-class cannels at the cheapest prices these have ever been sold at; or it might be raised to about 128s. per ton, and be as cheap as gas from Pirnie, or to about 170s. per ton, and be as cheap as gas from Arniston, Newbattle, Dryden, and Niddrie, at the current prices of these coals.

Coming now to consider the cost of a mixture of oil gas with gas from splint coal, I shall take it for granted that the Commissioners would not desire much to enhance the illuminating value of the gas as presently supplied, seeing that 26-candle power is as high as can be effectually consumed in ordinary burners. Taking it at that, therefore, the proportions of the mixture would require to be:

	Candles.
10,000 feet of 15 candle gas from splint coal	150,000
1,666 feet of 90-candle gas from oil	149,940
11,666 feet of very nearly 26-candle gas	299,940

Splint coals, to produce 10,000 cubic feet of 15-candle gas, can be bought now at about 9s. per ton, delivered in the Leith works, and the cost of the mixture would therefore be:

One ton of splint coal	9s.	0d.
Labor and purification, at 7d. per 1,000 cubic feet	5	10
	14	10
Deduct salable coke, 7 cwt., at 7s. per ton, 2s. 6d.; and liquid residuals, 1s. 8d	4	2
	10	8
Add for 1,666 cubic feet of oil gas	3	9
Total	14	5

This works out to a cost of 14.83d. per 1,000 cubic feet.

Compare this now with the corresponding cost per 1,000 cubic feet of gas, of about same quality, made in the Leith works since 1888, which was the cheapest year ever known; bearing in mind that 1888-9 is only for part of a year (omitting the months from May to August, when costs of manufacture are heaviest), and also that up to the beginning of the current year the return for liquid residuals was much greater than it is now:

Year.	Average Cost of Coal per Ton.	Average Net Cost of Coal per Ton.	Cost per 1,000 Cu. Ft of Gas Made for Coal, Labor, and Purification.
1888-89	10s. 5¾d.	7s. 5½d.	15.97d.
1889-90	11 9½	8 9	17.12
1890-91	15 5	11 8¾	22.19
1891-92	19 4¾	16 5½	26.69

The result shows the mixed gas from oil and splint coals to be fully 1d. cheaper per 1,000 cubic feet than the cost of gas from a mixture of cannel and splints when these were at their very cheapest, and nearly 14d. per 1,000 cubic feet cheaper than these were at the prices of last year. The cost for the current year will probably turn out to be about 3d. per 1,000 cubic feet less than last year, and the prospect is that there will be a further considerable reduction in the prices for the year 1893-4. It is certain, however, that the prices cannot again be as low as from 1888 to 1890; it being well known that they were quite unremunerative to coalmasters, and that since then there have been considerable and permanent additions to the on-cost of coal. It is unlikely, therefore, that the average cost of coal will fall to a price which will bring the cost for it and for manufacturing charges less than 20d. per 1,000 cubic feet made. The introduction of machinery for dealing with the coal would, no doubt, reduce labor charges considerably; but this would very slightly affect the relative costs, seeing that the mixed oil and splint gas is made from coal to the extent of six-sevenths of the whole, and would benefit to this extent in any reduced cost of working the coal.

Taking, therefore, the above 20d. per 1,000 cubic feet as the lowest probable cost for gas from a mixture of cannel and splint coals, there would be an advantage gained by the adoption of the mixed oil and splint coal gas process, not only as regards cost, but also as affording a check upon any rise in the price of cannel coals; that is, providing the cost for oil can be depended upon not to rise to such a figure as would add more than 5d. per 1,000 cubic feet to the present cost of the mixture (14.83d.), and thereby make it equal to that of the (lowest) probable cost for a mixture of cannel and splint. To raise the cost of the 11,666 cubic feet in the mixture by 5d. per 1,000 cubic feet would mean an addition of 4s. 10d. to the present cost of 3s. 9d. for the proportion (1,666 cubic feet) of oil gas; and this would be equivalent to a rise in the price of oil of from 40s. to 105s. per ton. I have made careful inquiry on this point, and have been able to avail myself of the experience of several gentlemen thoroughly conversant with the oil trade; and, while it is impossible for anyone to tell with certainty what the future may bring, it seems hardly possible that so considerable a rise should take place.

I have no hesitation, therefore, in advising the Commissioners to erect plant for the manufacture of oil gas as soon as it is possible to do so. This cannot be done at Leith, under present circumstances, as there is no space available for the purpose, and the retorts are already too few for the quantity of coal gas needed in the winter months. But there is very considerable spare retort power in the Edinburgh works, part of which could probably be made available for oil gas. If the Commissioners, when they come to consider the report I had the honor to submit to them at this time last year, as to the enlargement and rearrangement of the Leith works, approve of the scheme therein proposed, it can be arranged to make oil gas plant part of it.

In an appendix Mr. Linton says that the oil gas is manufactured as nearly as possible in the proportion of 1 volume to 6 volumes of mixed gas, and that, taking the quantities made from 4 P.M. on the 8th to 10 P.M. on the 10th of March, they were 12,670 cubic feet of oil gas, and 68,500 cubic feet of coal gas; the coal used being a mixture of Auchlochan and Bellfield splint. Two syphons on the mains outside the works were tested on the 10th. About half a pint of water, and nothing else, was found in one; and the other, on a 7-inch main, was found "blowing." The oil gas coke, which is of a very fine, hard quality, is readily sold in Peebles at £1 per ton. A sample of it was brought to Leith. On being tested, it gave only 0.33 per cent. of ash; whereas the coke from an average mixture of cannel coals will give from 10 to 12 per cent. of ash. A sample of the coal gas produced from the mixed charge of splint coals was tested on the 10th of March, and gave 13.67-candle power. Applying this to the gas made from the 8th to the 10th of March, the following results are brought out:

	Candles.
68,500 cubic feet of mixed gas, at 29.69-candle power	2,033,765
Of which 55,830 cubic feet are coal gas, at 13.67-candle power	763,196
And 12,670 cubic feet of oil gas, at 100.28-candle power	1,270,569

The analyses made at Leith of the coals used at Peebles show that, with a yield per ton equal to that given in the table of the three months' working there—viz., 9,610 cubic feet—the average quality of the gas

would not exceed 16-candle power. Applying this to the three months' working gives:

	Candles.
4,388,000 cubic feet of mixed gas, at 30.46-candle power	133,658,480
Of which 3,634,800 feet are coal gas, at 16-candle power	58,156,800
And 753,200 cubic feet of oil gas, at 100 candle power	75,501,680

The higher the coal gas result is taken, by so much is the oil gas result depreciated; and taking the coal gas at 18 candle power, and applying it to the three months' working, gives:

	Candles.
4,388,000 cubic feet of mixed gas, at 30.46-candle power	133,658,480
Of which 3,634,800 feet are coal gas, at (say) 18-candle power	65,426,400
Leaving 753,200 cubic feet of oil gas at 90.59-candle power	68,232,080

The Alexander-Paterson process has been seen in operation at Woodilee Asylum, Lenzie, near Glasgow, where there are 12 retorts erected, being the largest installation as yet made. The result per gallon of oil is stated, in the prospectus of the Company, to be about 90 cubic feet of 60-candle gas, with about 10 per cent. (in bulk) of a thin oily tar, and a small quantity of a pitchy deposit in the retort. The results stated to be obtained are very similar to those arrived at by other processes of the same class. Lately some experiments have been made with a retort on the premises of the Company in Glasgow, in the direction of making a smaller quantity of gas of a higher quality per gallon, and trying the effect of mixing this with ordinary Glasgow gas. There is subjoined a report by Mr. R. R. Tatlock, Public Analyst and Gas Examiner for the City of Glasgow, of a test made by him, in which, however, there is no information as to the quantity of gas made per gallon of oil when the gas with which he experimented was produced. The quantity of the gas made per retort was stated to be 2,000 cubic feet per 24 hours. With our coal gas retorts, and with the retorts in Young's process (which, however, are larger), about five times this quantity is made per 24 hours; so that the Alexander-Paterson process would require, relatively, a very large amount of plant for the manufacture of a given quantity of gas. To fit up a small plant of these retorts, as proposed in Mr. Holms's letter to the Lord Provost [of Edinburgh], would not be of any service unless the apparatus were made complete throughout, so that the oil gas could be mixed in a holder with a given quantity of coal gas of ascertained quality, and the results carefully tested. To do this, and provide not only for retorts and condensers, but for exhauster, purifiers, meters, and gasholder, would cost nearer £2,000 than £200; and I cannot recommend the Commissioners to incur that expense. The Patent Paraffine Gas Lighting Company should do as has been done by Mr. Young at Peebles viz., get the use of a small gas works, and put up plant there on a working scale, with the necessary apparatus for checking exactly the results obtained as to quantity and quality. If they are then satisfied that the results obtained are better than those from other processes, an opportunity can be afforded to those interested in the matter to test the working for themselves, as has been done at Peebles with Mr. Young's process.

Steam Versus Water Power.

By Mr. Samuel Webber.

Two papers were presented to the American Society of Mechanical Engineers in 1889, one by Chas. H. Manning, of Manchester, N. H., and one by Chas. T. Main, of Lawrence, Mass., in which they take for a basis, on the one hand, a 1,000 horse power compound steam engine, which produces steam at almost the lowest cost, and if not quite so low as it might be produced on a 2,000-horse power engine, or a 10,000 horse power one, on an ocean steamer, far lower than the average engines in use in the United States will possibly produce it. This cost they compare with the cost of water powers at Lowell and Lawrence, where large extra expenditures have been made to enable the mills to use all the water flowing in the river at any time in the year, except for a week or two in the spring, when the snow is melting, and where wheels of 19,000-horse power have been placed in the mills at Lowell, instead of the original 9,000-horse power which the river was calculated to supply, and by adding to this the cost of land used for dwelling houses, streets, etc., they contrive to figure out a cost of water power equal to that of steam. Also, both Main and Manning have been connected with establishments using an enormous quantity of steam for dyeing, drying, etc., and where the cost of power can be made very low by charging generously to the other purposes for which steam is required and leaving a small balance for power.

This they have a right to do, for it is well known that the additional fuel required to raise steam from 15 pounds per square inch to 100 pounds is but a small proportion, and where the steam is wanted at 15 pounds for other purposes power can be cheaply obtained.

What I consider a far more reliable estimate of the cost of steam power has just been published by Chas. E. Emery, of New York, in the March number of the *Transactions of the Electrical Engineers*, based on engines of 500 horse power, which is far nearer an average size, and with which the cost of everything except coal comes higher than with an engine of 1,000-horse power. I have been over Mr. Emery's table carefully, and find it to agree closely with my own experience as to steam, but he is misled by following Mr. Main and Professor Swain as to cost of water, for much of the expenditure to which those gentlemen refer has been an afterthought, paid for from the profits, to secure more water than was contemplated in the original outlay. All these gentlemen are late comers on the scene of action, and have not, like the writer, who went to Lowell in 1841 and Lawrence in 1847, seen the gradual development almost from the beginning.

When I went to Lowell, I understood the cost of power to be $300 per annum per "mill power," so called, of 60 horse power approximately; $5 per horse power being the sum reserved as annual rental, to pay for the water, when the land and rights were sold by the Locks and Canals Company to the different manufacturing corporations. This is confirmed by the records of the Locks and Canals Company in 1823, which show the cost to enlarge the canal locks, in addition to the cost of first purchases, viz., $18,339 for land, and $30,217 for canal shares—to have brought the whole expenditure up to $120,000 per 50 mill powers, or $40 per horse power, so that the rental of $5 per horse power was equal to 12½ per cent.

The late Samuel Batchelder, of Cambridge, who was the first agent of the Appleton Manufacturing Company, at Lowell, in 1828, and afterward built the York Mills at Saco, and was finally treasurer of them, estimated the total cost of water power in Lowell, including interest on plant and land, to be $15 per horse power in a little "History of the Cotton Manufacture in New England," published by him a few years before his death. In 1845, when the original estimated water power of Lowell was taken up, it was found that the old canals were so narrow as to cause a very considerable loss of head before the water got to the mills, which was of considerable importance to those on the "upper level" of only 14 foot fall, and to save that loss and also to catch a great deal of water which ran by for some part of the year, a new canal was built at a cost of $530,000—far more than the whole original outlay. Then in connection with the Essex Company, at Lawrence, water rights were purchased at Lake Winnepesaukee to hold and store water there during the spring for summer use, and in this way the expenditures for water power have been gradually built up, till they reach the figures given by Professor Swain and Mr. Main, which, however, have nothing to do with the original or necessary investment. Lowell was laid out for the old wooden breast wheels on two levels, with the exception of the Merrimac Mills, and were it to be built to-day, with turbine wheels, using all the fall on one level, could be completed, with canals of sufficient dimensions, for much less than half what it cost for power plant.

The cost to the Essex Company at Lawrence was also vastly increased by a change of plan from the south to the north side of the river, making the first canal cost $250,000, instead of $125,000, which the second canal, built subsequently on the south side, has cost. All the water could have been used on one side of the river, but to make the land on both sides available the two canals have been cut, greatly increasing the cost per horse power.

The gentlemen who have written on this matter have, without question, done so in perfect honesty; but, in their entire ignorance of the history of the growth of the water power, they have drawn very erroneous comparisons, and the 19,000 horse power attainable at Lowell by their turbines should be used as a devisor instead of the 10,000 usually taken.

If they estimate the cost of steam per horse power from a 1,000 horse power compound engine at from $21 to $22 per horse power, I claim the right to estimate a water power on 30 foot fall, with modern turbines, at a total cost, land included, of $100 per horse power, interest, taxes, repairs, oil and attendance, on which, all included, would bring the cost of water power down to less than $10 per horse power.

I wish, however, to refer again to Mr. Main's paper, which I consider a very valuable one and very correct in its estimates, if the charges for cost of land, line *b*, Table VI., and all the items after it, being penalty charges for surplus water, are omitted. Line *a*, in Table VI., I believe

to represent the cost of water power fairly, and also column 24, in Table IV., that of steam; and from those two points of view a fair comparison can be made.

The head of water which can be obtained is, of course, a most important factor in this matter; and although the probable cost of dam and canal for a 30-foot fall would be more than for one of 10 feet, on the other hand the cost of wheels and feeders for the same power would be less, and it would not be far out to assume the cost of a horse power (of water) on a 30-foot fall at one-third of what it would be on 10 foot falls.

Gasification of Coals and Liquid Hydrocarbons.

[A paper read by Dr. P. Dvorkovitch before the London Section of the Society of Chemical Industry.]

Dr. Dvorkovitch at the outset said that the subject dealt with in this paper had been so frequently discussed by so many eminent men that there was little left for him to say. After a reference to the knowledge of inflammable gases possessed by the ancients, he proceeded to say that to the ignorant the phenomena exhibited by such gases were inscrutable, but that the practical mind soon set to work to produce gas and make money. But the practical application of the knowledge took place only at the beginning of the present century. The inventors were Winsor and Murdoch; but they possessed very little knowledge of the chemistry of the gas with which they were dealing. He thought he was right in saying that up to the present day the gasification of coal and liquid hydrocarbons had not received that study from chemists to which it was entitled—that the subject had remained in the hands of engineers, and had been continued on the lines upon which it was started. The greatest minds in the world of chemistry had devoted themselves to the study of the bye-products which the engineers had created, and which rightly enter into the researches of the chemist. He might say at once that he hoped to show that a new and important discovery had been made. What he really desired to do was to show the knowledge he already possessed, and to ascertain how far the present methods of treatment were in accordance with the established facts of chemistry, and what improvements might be made. He would first consider the results obtained from the present methods of gasifying coal, in respect to the production of gas and bye-products, and then he would show what experiment had proved possible as regards both gas and bye-products. He would also treat of the gasification of liquid hydrocarbons and its improvement. Dr. Dvorkovitch here briefly referred to the published work of Mr. Foster, to show what are the present day results of gasifying coal, and said that only 300 lbs. of the ton of coal was obtained as gas, the remainder being lost in the course of gasification. The serious attention of gas engineers should be turned to some better method of treating coal, so as to obtain the maximum of illuminating hydrocarbons and the minimum of hydrogen. After a reference to the effect of temperature upon the product of coal distillation, Dr. Dvorkovitch said temperature had the same effect in the distillation of petroleum. If they considered the present method of the gasification of coal, they would see that there existed all the conditions for destroying the gas—the temperature was so high that the gas and the hydrocarbons were destroyed; hydrogen was consumed by the oxygen of the coal, and a further quantity went to form ammonia.

The present method of gasifying coal must, he said, be abandoned and the temperature lowered. He expected that such a radical opinion would meet with great opposition from gas engineers and chemists, but the value of the industry was too immense to let that prevail. In explaining what by experiment he had found possible, he would assume coal to be fixed carbon saturated with hydrocarbons, mostly belonging to the paraffine series. As far as he knew, Mr. Taylor was the first to obtain a patent for the manufacture of oil gas, in 1824. Shale oil was used, and the apparatus employed was so simple that Mr. Taylor was able to form a large company to work it, through which there were lost $340,000. Taylor's apparatus had been varied by many inventors, but all had the same view—the gasifying of the whole of the oil—and therefore all had failed. The high price of liquid hydrocarbons and the absence of proper chemical knowledge of the method of gasification had hitherto resulted in failure. The attempt had been made to gasify the whole of the oil treated, without leaving any residuum, and unfortunately most of the inventors had succeded in this attempt. The gasification of oil had been based upon the method of gasifying coal—namely, to destroy the unsaturated hydrocarbons; and this had been the main cause of wastefulness. In Russia, although the gasification of oil was carried on mainly with a view to obtaining bye-products, yet under certain conditions the same quantity and quality of gas were obtained as in England. Of course, in Western Europe and America, where gas was largely used, it was natural that the production of gas should be made the main object; but in Russia, where gas was little used, the chemists had to devote their energies to the production of bye-products.

In the experiments he wished to detail he had employed three distillates—solar distillate of 0.8625 specific gravity, special solar distillate of 0.8852, and special distillate of 0.8891. He gasified them in an apparatus consisting of two iron pipes laid one above the other, and connected at one end. Distilling solar oil at 1,600° F., he obtained 120 cubic feet of 22-candle gas per gallon, or 576 candles per gallon, and 32 per cent. of bye-products. At 1,300° F., the yield of gas was lower, but the quality was much higher—the candles per gallon were 665; and the bye-products were also much larger in quantity. It seemed to him that from the first invention of gasification down to the present day an enormous loss had been going on, and it was really wonderful that the subject had not attracted more attention.

So far as he was aware, hardly any criticism had been made upon the methods of coal gasification since it was invented; and this being so it was not strange that little progress had been made. He had experimented by his method with Yorkshire coal, and he had obtained 20,000 candles from the ton, and from the resulting residuals he had obtained a further 11,000 candles, making a total of 31,000 candles, as against 24,000 candles obtained by the ordinary process; in addition to which he had 40 per cent. of residuals.

To sum the matter up, by the ordinary process they obtained 24,000 candles per ton and 10 gallons of tar, 95 per cent. of which was of small value, whereas by his process they obtained 31,000 candles and 8 gallons of paraffine, from which resulted 4 gallons of bye-products of great value. It was also an interesting fact that the existence of paraffine in coal is not limited to gas coal, as house coal contains an almost similar quantity of coal oils and paraffine. The fact that coal contains paraffine in such large quantity he thought sufficiently interesting to put before them, and he hoped on another occasion to have an opportunity of laying before them some information as to the chemical nature of the products he had obtained. By his process he also obtained a larger quantity of superior coke absolutely free from sulphur. Of course, the method he had sketched was too radical to be rapidly adopted, but he trusted that by gas engineers and chemists working together the present wasteful method of gasification would be somewhat ameliorated.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. C. E. Davenport has been chosen Treasurer of the Troy (N.Y.) Gas Company, vice the late Mr. Derrick Lane; Mr. Davenport also retaining the position of Secretary, which office he has filled most acceptably for several years. The appointment is an excellent one.

The following interesting communication, on the matter of "A Basis for Determining the Proper Salary for a Gas Superintendent," is from Mr. Eugene H. Yorke, of the Jamaica Plain (Mass.) Gas Light Company:

To the Editor American Gas Light Journal: The wide variation in amount of salary paid to gas superintendents by different companies having the some output suggests the desirability of fixing on some basis for determining the reasonable and proper salary that such officers should receive. I therefore would suggest the following for a basis, to wit:

Initial salary (care of works only)	$1,200	per annum.
To be added for each 1,000,000 cubic feet increase in make of gas, above 5,000,000 cubic feet make	25	"
If he has the care of street mains and services, add for each 1,000,000 cubic feet increase in make, above 5,000,000 cubic feet make	10	"
If he has the care of meters, complaints and gas stoves, add for each 1,000,000 cubic feet increase in make above 5,000,000 cubic feet make	10	"

Thus, when a superintendent has general charge of a company, making, say, 50,000,000 cubic feet per annum, his salary would be as follows:

Works	$2,325
Street mains and services	450
Meters, complaints, and gas stoves	450
Total	$3,225

I do not think that any company can reasonably say that this is too high a salary for the services, in view of the special equipment required

(which is acquired only by years of hard study), and the skill, intelligence and tact necessary, together with the constant care, labor and study involved. I do not mean to say that superintendents who are now receiving a higher salary than would figure out on the above basis are being overpaid, for he may be an exceptionally efficient manager, and one who makes so much money for his company that it would be profitable for his company to pay him *double* the sum that a salary on this basis would amount to; but I do say that any company that now has an efficient and energetic superintendent, and is paying him a *less* sum than a salary figured on the above basis, is not fairly remunerating its superintendent. When a gas company also operates an electric plant, and the care thereof devolves on its gas superintendent, it would seem but fair that an amount, equal to at least one half of the gas salary, should be added to it, for the increased care and labor involved in attending to the operation of that department.

THE proprietors of the Mutual Gas Light Company, of Savannah, Ga., have notified the residents that hereafter the net gas rate shall be $1.60 per 1,000 cubic feet, a concession of 20 cents per 1,000.

THE proprietors of the New Rochelle (N.Y.) plant of the American Gas Company have awarded the contract for a new gasholder to the Davis and Farnum Manufacturing Company, of Waltham, Mass. The same contractors will also construct the tank, which is to be of masonry. The holder is to be of the double-lift order, 80 feet in diameter, sections 25 feet, the working capacity to be 250,000 cubic feet.

THE following from the Providence (R. I.) *Bulletin* will be read with interest: "The introduction of the electric light in Providence has not, contrary to the assertions made when the commercial success of the new illuminant was assured, injured the business of the Providence Gas Company. While the use of arc and incandescent lamps has become general, gas has more than held its ground, and from year to year the output of gas has been increased, notwithstanding the energetic work of the electric company which entered the field a few years ago. At first thought it might seem that the consumption of so much electricity necessarily reduced the amount of gas burned, but the figures in Providence, as in other cities, tell a different story; and so far as can be determined by existing conditions, the gas industry is in no danger of depreciation. Like other communities, Providence is finding use for a great amount of artificial light. Every building connected with the electric light station has the usual number of gas burners. At present, gas is the more reliable, if not the better of the two illuminants. The desirability of the incandescent lamp in proper order cannot be questioned, but as every one knows, there are times when the consumer thinks he has reason for exclaiming that the dynamo is not without its bad features. The service may be good day after day, and without warning the light may be extinguished or grow dim and then gradually become brighter. This is a common and trying experience, and indicates that electric lighting is not yet a complete success. The current may be impaired or stopped by the slipping or breaking of a belt, and on such occasions the consumer finds relief in gas, which can be depended upon at any hour of day or night. But, notwithstanding the disadvantages referred to, the electric light may be considered as one of the necessities of the times; the frequent additions to the plant conclusively show that it is an established and growing industry, and the operations of the Gas Company also warrant the statement that electric light competition has not interfered with the interests of the holders of gas stock. In 1890 the sales of gas in Providence amounted to 475,424,000 cubic feet, in 1891 the quantity manufactured was 503,408,000 cubic feet, and in 1892 there was a gain of 13,318,000 feet over 1891, the latest product being 516,726,000 cubic feet, or a gain of 41,302,000 cubic feet over the output of 1890. From the first year there has been a steady increase in the demand for gas, with the exception of a year or two after the panic of 1873, when there was a slight falling off, and what the increase might have been during the past few years if the electric light had not been developed, it is of course impossible to determine; but the statistics of 1890-91-92 are sufficient to prove that gas is in no immediate danger of being superseded."

THE Noteman Gas Generator Company has been incorporated at Chicago, with a capital of $500,000, by Messrs. A. Noteman, William R. Burritt and Day O. Crane. The objects as set forth are "the manufacture of fuel gas generators, and materials from which gas may be generated; also the supply of pipes, fittings, etc."

THE proprietors of the Northwestern Gas Light and Coke Company, of Evanston, Ill., have filed a bill in the local Circuit Court against the city of Evanston and its officials. The prayer of the bill is for an injunction restraining the defendants from interfering with the Company in the laying of new and the repairing of old mains. The Company, which was organized on Feb. 21, 1867, has the exclusive right to supply the city with gas, and its charter and the ordinance of the city under which it operates, give it the right to tear up any street for the purpose of laying or repairing pipes. Recently the demands on the Company have greatly increased, which necessitates the placing of main lines in new districts. In addition to this many of the old lines must be replaced by lines of larger diameter. Soon after Evanston was incorporated ordinances were passed providing for the paving of many of the streets with cedar blocks. Among these streets is Ridge avenue, now being paved between Emerson and Crane streets. It so happened that the Gas Company was laying new pipes on this street, but on May 6th the Commissioner of Public Works, H. H. Maddock, asserted that the Company was a trespasser, and appealed to the police bureau to order the Company's men to stop work, under the penalty of arrest for disobedience. This order was carried out. The plaintiff seeks relief from the stress, and asserts that it is using all diligence to complete the work. The whole thing looks to be a strike on the part of somebody, for we understand that the Council has been appealed to to pass an ordinance decreeing that the Company must lay its pipes in the streets that are to be repaved prior to the time that the paving is done, or forfeit its right to put in any pipes; and this certainly is a queer move, for the Commissioner and the police are straining every point to prevent the Company from accomplishing that very object.

MR. JOHN COLLINS has been appointed Superintendent of the plant recently constructed by Mr. Van Steenbergh for the supply of gas to the towns of Rutherford and Boiling Spring, N. J.

THE agitation by the city, as owner of a round block of stock in the Portland (Me.) Gas Light Company, for the declaration this term of an extra dividend, has been very wisely responded to by the Directors of the Company, in their determination not to increase the dividend rate, but to order a reduction in the ruling charges for gas. Accordingly, on and after July 1st, the gross rate is to be placed at $1.60 per 1,000 cubic feet, prompt payment to entitle the consumer to a rebate of 10 cents per 1,000. The present schedule calls for $2 per 1,000, with 20 cents off for prompt payment.

AT the annual meeting this year of the town of Attleboro, Mass., the voters agreed to appropriate the sum of $50,000 for the erection or purchasing of an electric lighting plant, and a committee was appointed to carry out the directions of the vote. Mr. Homer M. Daggett, President of the Attleboro Steam and Electric Company, which concern also operates in the adjoining precinct of North Attleboro, was interviewed by the committee in respect to the purchase by the township of the electric plant, subject to the statutes of the State that govern the matter of the purchase of plants now in operation. According to the committee, Mr. Daggett held his property at an exorbitant figure; and it (the committee) asks for a hearing before a master and a board of appraisers, to determine a rightful valuation. Those interested in the municipal scheme of operation have divided over the proposed purchase to the extent of taking sides as to whether it would be wiser to institute eminent domain proceedings for the acquirement of the property, or to follow the course outlined in the latest general statutes. Meanwhile, Mr. Daggett and his associates of the Steam and Electric Company are willing to entertain a "reasonable proposition;" for it is quite an open secret that they have not been enriched by the ownership of the aforesaid Steam and Electric Company's right to supply electric currents.

COLONEL JEREMIAH COVENEY, who has been appointed Postmaster of Boston, formerly served on the Massachusetts Board of Gas and Electric Light Commissioners, and good service he rendered there, too.

THE Council of Salt Lake City, Utah, has passed a resolution granting the right to the Salt Lake and Ogden Gas and Electric Light Company, which concern recently took over the rights and properties of the Salt Lake City Gas Company and the Salt Lake Power, Light and Heating Company, to supply gas for a period of 25 years. The Company agrees to charge not in excess of $2.50 per 1,000 cubic feet gross, the city and "religious and charitable organizations" to be allowed a discount of 10 per cent. It is also guaranteed that the illuminating power of the gas supplied shall not be less than 18 candles, "subject to inspection by a proper officer."

MR. J. H. WOODSON is acting as Superintendent of the Staunton (Va.) Gas Works.

On motion of Mr. Tingley, at a recent meeting of the Pawtucket (R. I.) Council, the Committee on Street Lights was authorized to enter into a contract with the Pawtucket Gas and Electric Light Company for the public lighting of the city for a term of 3 years, in accordance with the terms of the following proposition submitted by the Company:

"We hereby respectfully present for your consideration the following proposition for the lighting of the streets of the city of Pawtucket for the term of 3 or 5 years. We will furnish the city with the present number of lights they now have, or as many more as they may order for the term of 3 or 5 years (reserving the privilege of shutting off on moonlight nights, not to exceed three nights from a full moon, with the consent and approval of the Superintendent of Street Lights), agreeing to light not less than 330 nights in the year, and as many more as it may require to light the city, and not have a dark hour within the time specified for lighting and putting out, as provided for in our last contract. *Proposition:* Full arc lights under this proposition, $150 a year. It cost the city last year for 318 nights, $146.40. At the same rate this year, for 330 nights, it would cost $154. Divided arc lights, under this proposition, $85 a year. It cost the city last year, for 318 nights, $84.80 At the same rate for this year, for 330 nights, it would cost $88. It must be borne in mind that last year we started the lights 31 nights for a part of the night, and called two nights one. This was not called for in our contract. If the city had paid every night it would have cost for divided arcs $88 per light. There are many dark hours in the year when the lights ought to be and are not burning, but we had no orders to light them. Under this proposition it would not occur. Our Company would prefer to take the responsibility of lighting the city (under the direction of Superintendent of Street Lights), as proposed, at a less price per light per night than under the old contract, believing they can by doing so give the public better satisfaction. It is further agreed that the price of gas consumed by the city shall not exceed $1.50 per 1,000 cubic feet.—L. B. Darling, Chairman of the Committee."

Mr. Frank J. Brown, Jr., of Troy, N.Y., has been appointed Superintendent of the electrical division of the plant of the Charleston (West Va.) Gas and Electric Light Company.

Judge Holmes, of the Massachusetts Supreme Court, recently handed down the following decision, in the matter of a petition of Mr. J. Edward Addicks, on behalf of the Boston Gas Light Company, by which the latter sought to restrain the Brookline Gas Company from laying mains in the city of Boston proper: "This bill is brought by the chief officer in a rival corporation in the hope of impeding, and, if it may be, ruining the defendant. The ground is not the usual one for such proceedings, viz.: That the funds of the defendant, in which the plaintiff has an interest, are being diverted to a different enterprise from that into which he went. On the contrary, the business is that for which the corporation was chartered, and the contract which it has made is admitted to be lawful. The ground is simply that in carrying out a lawful business and a lawful contract the defendant has neglected to get a license which the plaintiff says is necessary. Supposing it is so; what harm will ensue to the corporations? A court of equity does not enjoin every act of a corporation which may turn out to be illegal. The rights attached to the ownership of a share of stock do not go as high as that. I must be satisfied that some substantial interest of the plaintiff's stock in the defendant Company is imperilled before I move; but to me every step of the plaintiff's argument seems doubtful. I doubt whether under the charter of 1885 the Superintendent of Streets has not the power which he has exercised for years without question. I doubt whether, if he has not, the Aldermen could forfeit it, or even order to be taken up the pipes, now laid and covered in, as a penalty for not having got their leave. I doubt whether anything more would happen to this defendant than the infliction of a slight fine. If the Aldermen would grant the license in case it were held necessary, they will not attempt to injure the defendant for pursuing the course which has been practiced and has been supposed legal for years. If the Aldermen would refuse the license, my injunction would mean a prohibition of the defendant against proceeding, and that now would mean ruin in the present state of the work, and would have meant serious loss when the plaintiff filed his bill. I shall not ruin the defendant to avoid the chance of ruin hereafter."

Plaintiff naturally is anxious to have the appeal, which he is to take from the decision above given, heard at the sitting of the full Bench of the Supreme Court, convened for to day. Plaintiff's counsel (Mr. J. B. Warner) appeared before Chief Justice Field on May 13th to move that the case be reviewed by the full Court at the immediate sitting. He urged that unless the matter was speedily heard, a later hearing would be of no great advantage to plaintiff, because the gas mains of the Brookline Company would have been all laid before the Court would again convene. While we do not know positively that such is the case, we believe that the Chief Justice endorsed Mr. Warner's plea.

Patrick McCann, for 25 years a faithful subordinate in the employ of the Worcester (Mass.) Gas Light Company, is dead. He was in his 59th year.

We are indebted to "C. R. S.," of Portland, Oregon, for the following: "I have to inform you that a consolidation of the properties of the Port Townsend Gas Company and the Port Townsend Electric Light Company, of Port Townsend, Wash., has been effected, both corporations having been absorbed by the proprietors of the newly organized Port Townsend Gas and Electric Light Company. The new concern is capitalized in $150,000, all of which stock has been subscribed for. The incorporators are chiefly the owners who were interested in both of the old corporations; and the Trustees for the first year, as elected at a meeting held at Seattle some days ago, are E. B. Downey and W. J. Gamb, of Seattle, S. Z. Mitchell, of Portland, and F. A. Bartlett and John Lillie, of Port Townsend. I am more than pleased to add that Mr. John Lillie has been appointed General Manager of the combined enterprise, for a better selection could not have been made. Most of the old employees will be retained, and it is virtually assured that a reduction in the selling rates for gas will be speedily announced. The Company will at once make material improvements on its properties."

The California Gas Light and Fuel Company has been granted a franchise for the operating of a gas and electric light plant at Healdsburg City, Cal. Our informant adds that this likely means the transfer to new interests of the property and rights of the old Healdsburg Gas Light Company.

At the annual meeting of the Mechanicsburg (Pa.) Gas and Water Company the following officers were chosen: Managers, Fred. Wonderly, Joseph Elcock, Joseph Milleisen, George S. Comstock, Calvin Clendennin, George A. Zacharias, Jacob H. Koller, H. L. King and S. F. Hauck; President, Fred. Wonderly; Secretary, A. Z. Myers.

The Louisville (Ky.) *Times* is our authority for the statement that the Louisville Electric Light Company has advanced its sales' schedule from .50 cent per ampere-hour to .75 cent per ampere-hour, and that the Citizens Electric Light Company has also increased its rates proportionately.

At the annual meeting of the Chester (Pa.) Gas Company the following officers were chosen: Directors, J. R. Johnson, Samuel A. Crozer, Stephen Cloud, Jr., John O. Deshong, Jr., and J. H. Roop; President and Treasurer, Jonathan R. Johnson; Secretary, J. H. Roop.

The Elgin (Ills.) American Gas Company does not experience any great trouble in the selling of its coke for 10 cents per bushel. Of course, the fuel is prepared for the varying purposes for which it is employed.

The New England Automatic Gas Company has been organized at Berwick, Maine. The capital stock is $50,000, and its officers are: President, Walter E. Drake, of Boston; Treasurer, Daniel M. Keigwein, of Boston. Its objects are "to make and sell illuminating gas and machines for operating same."

The Consolidated Company, of this city, is relaying a great part of its uptown main system.

The Ellenville (N.Y.) *Press*, referring to the probable purchase by the township of the gas plant at that place, says: "The Trustees have agreed to buy the gas plant in the village at the price at which it was bid off by the present holders, with interest from the sale until the time of purchase, making the cost about $11,000. Bonds are to be issued to the amount of $18,000 and sold to the best advantage, to secure money to pay for the works and to put them in serviceable order. Work will soon commence, so that everything may be ready for use when the present lighting contract expires next spring. It is estimated that gas can be made and sold at a cost not to exceed $1 per 1,000, at which price many people are sure to use it, as it will cost not much more than oil, and will be more desirable in every way."

Messrs. George M. Clark & Company, of Chicago, the manufacturers of the well-known Jewel gas stoves, held "open house" for the gas men during the convention of the Western Association.

The Market for Gas Securities.

During the week the market for city gas shares showed marked symptoms of a return to normal, Consolidated showing a gain of about three points. To-day (Friday) the opening was made at 119¼, and quite a number of orders were reported in hand. There ought to be 10 points in Consolidated before July 1st. Other city gas stocks were dull and unchanged, save Standard, which was a trifle easier. Brooklyn stocks are very weak, everything on the list having failed to regain the sharp decline of 10 days ago. In the meantime we are assured that the leading spirits in the gas situation are quietly getting closer together in respect of an agreement. Chicago gas opened to-day at 74⅛; Laclede common is at 15½ to 17½, and the preferred is reported at 57 to 60. The regular quarterly dividend of 1¼ per cent. on the preferred is declared, and is payable on June 15th. Rochester common is quoted at 80 to 85, while the preferred is held at 10 points higher. Bay State is dull, at 21 to 22; and Baltimore Consolidated declined to 59.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

May 22.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	119	119¼
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	192	195
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	140	145
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	35	40
Preferred	5,000,000	100	80	85
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	—	113
Citizens	1,200,000	20	105	107
" S. F. Bonds	320,000	1000	—	103
Equity Gas Light Co	2,000,000	100	45	—
Bonds	1,000,000	—	—	60
Fulton Municipal	3,000,000	100	130	—
" Bonds	300,000		102	—
Peoples	1,000,000	10	—	94
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	—	118
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	150	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	107	110

Position Wanted.

Young man wants position as Superintendent of Gas Works in a Western or Southern city or town with good prospects. Might take a works on lease. At present in charge of an Eastern gas plant. Best of references can be obtained from officials of the Company in which he has been employed for the past 6 years. Present salary no object provided a satisfactory opening can be found. Address "L. W.," care this Journal.
937-3

Position Wanted

AS SUPERINTENDENT OF A GAS WORKS

by a man fully competent in all respects, and who has had 20 years' experience. Best of references.
937-3 Address "D.," care this Journal.

WANTED,

A young, active man, with sufficient knowledge of the gas business

To Take Charge of a Small Gas Works,

set meters and stoves, run services, take statements and make collections. Address, giving age, experience and references
937-3 "A. O. C.," care this Journal.

SERVICES FOR SALE,

As Superintendent or Manager of Gas Company.

A young man with first-class technical education, and a chemist, with best of references; acquainted with coal and water gas; five years' experience from office to retort house, as Superintendent of a small Gas Company. Change of location desired to a larger field. Address
936-tf "I. A. C., care this Journal

WANTED,

An Expert Meter Repairer.

To a thoroughly efficient man good wages will be paid. Apply, with testimonials, to

SUPERINTENDENT ALTOONA GAS CO.,
936-2 Altoona, Pa.

Position Wanted

As Superintendent of Gas Works,

by a man fully competent in every respect, and who has had 20 years' experience. Or **would Lease a Small Works.**
930-tf Address "J.," care this Journal.

WANTED,

Three or Four Purifying Boxes,

Not less than 8 feet square.

Address CAPITAL GAS AND ELECTRIC LT. CO.,
935-6 Frankfort, Ky.

FOR SALE,

An 8-Inch Displacement Exhauster.

Address MORRIS, TASKER & CO.,
937-tf Philadelphia, Pa.

FOR SALE,

A Set of Second-Hand Purifiers, 6 x 8 Feet,

in good order, with 6-inch Connections and Dry Center-Seal Will sell separately or together.

C. S. HAMMATT, Supt., Citizens Gas and Electric Co.,
937-tf Jacksonville, Fla.

For Sale.

One Exhauster, 10-in. Connections and Bye-Pass Valves; also Pressure Governor attached.
Two Small New York Safety Engines.
One Small Upright Boiler, for making Steam for Exhauster.
One Hydraulic Main, with 6-in. Connections, for five benches of 5's, with 10-in. Outlet Connection.
One Hydraulic Main, with 4-in. Connections for four benches of 3's, with 4-in. Outlet Connections.
Four Purifiers, 10 x 12 x 3 ft. 15-in. Seal and 10-in. Connections. Dry Center Seal.
60-inch Station Meter and Stand (American Meter Co.); 8-in. Connections.
One Multituber Condenser, 16 x 4 x 4 in. Pipes. 10-in. Connections, with four-way Valves on Connections.
Two Scrubbers, 4½ x 4½ x 12 ft., with 10-in. Connections and four-way Valves on Connections.
Seven New Mouthpieces for 5's. Also,
Tools for Retorts, and **Connections** for five benches of 5's and four benches of 3's, with **Mouthpieces** for same.
For full particulars address DELA. COUNTY GAS CO.,
935-4 Chester, Pa.

Proposals for Coal Tar.

The Nashville (Tenn.) Gas Light Company proposes to sell one year's output of Coal Tar, beginning on July 1, 1893. The amount of same will be about four thousand (4,000) barrels. Bids for same are solicited.

NASHVILLE GAS LIGHT COMPANY,
936-2 Nashville, Tenn.

FOR SALE.

A Six-Inch Connelly Governor.

In perfect order; used only a short time.

Address P. O. Box No. 3582,
936-2 Boston, Mass.

FOR SALE,

Two Ten-Inch Dry Center Seals,

in good condition, and one

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